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1. Having Enough Food For Our World

The old man stopped for a moment to rest as the sun began to sink on the horizon. He shared a laugh with old Rob, the mule, as he wiped the sweat from his brow. Another day of plowing done, and maybe it will rain.

We're a long way from this quiet twilight hour on a small farm when we stare down the long brightly-lit aisles of a "modern" supermarket, and we're also a long way from our own *roots*. We now live in a society where we can actually pass through life without growing a single carrot or piece of fruit. All Life Scientists should become as involved with life in all its aspects as they possibly can. Hopefully all of us have experienced the joy and wonder of planting a seed and watching it bloom and bring forth its gift to us: life. It is truly miraculous to behold the transformation of life that occurs when food is ingested and it becomes a part of our very being.

Like air, food *is* a miracle; it is also a union of nature's creation and human effort. When food is available in sufficient quantities, we tend to take it for granted, like the air we breathe. World leaders come and go, astronauts circle the earth in the space shuttle, but without the farmers and harvests, all else would be meaningless.

In the twentieth century, only one out of two people works in agriculture (the majority are women). In the past, the vast majority of people who ever lived were farmers. More than 20 centuries ago, a Chinese poet wrote:

"When the sun rises, I go to work,
When the sun goes down, I take my rest,
I dig the well from which I drink,
I farm the soil that yields my food,
I share creation, kings can do no more."

And so it is.

In the midst of an era of persistent hunger and poverty, this fertile earth could produce more than enough food to meet our needs today and for the foreseeable future. Yet many people cannot afford to buy food; others are denied their ability to produce it because they have no access to land, seeds and tools. Others face erratic weather conditions, poor soil and a scarcity of water.

Two-thirds of our exported grain goes not to feed starving children, but to feed hungry animals raised for meat that is too expensive for hungry people to buy. Many areas of the world have the capacity to feed themselves but their cropland is being used to grow cash crops for *export* to the developed world.

1.1 Sharing the Harvest—Starvation and Malnutrition in the World

Population increases by exponential growth or multiplication; a system variable can continue through many doubling intervals without seeming to reach significant size. But in one or two *more* doubling periods, this size can be considerable. After 4,000 recorded years of human history (in the Bible), world population grew to an estimated 300 million people by 1 A.D., and reached a billion in the early 1800s. By 1930 (about 100 years later), the population had already doubled to 2 billion. Within another 30 years, another billion was added, reaching about 3 billion in 1960. Fifteen years later (1975), it was about 4 billion. From mid-1982 to mid-1983, world population rose by 82 million. In 1983 the estimated world population was between 4.6-4.7 billion (*twice* the global population of 20 years ago), and will probably reach 5 billion by 1986.

Today about 75% of the world's population live in the "underdeveloped" nations, 40% of these in extreme poverty. Political and economic pressures are rising in many nations. Countless refugees migrate, hoping to find salvation in a new country, just as our ancestors did when they came to this new world. Often those who themselves have next to nothing reach out to these refugees and offer shelter; others are not so pure in spirit and greet refugees with hostility, or even drive them away. Most Americans have, for the most part, been fortunate and have not really ever suffered from starvation, but as human beings we must ask ourselves how we would feel if the hand reaching out for help and a morsel of food were our own, and we were turned away.

Statistics indicate that a person born in the richer, industrialized countries will consume during a lifetime *20 to 40 times* as much as a person born in Africa, Asia or Latin America. Another statistic says that the average American consumes 2 1/2 times as many pounds of food over a lifetime as the average Asian, eating about 30 tons in a lifetime compared to an Asian's lifetime total of about 12 tons, which is mostly in rice. Westerners average almost 5 tons of meat, 1 1/2 tons of sugar (*not* including cakes, pastries and ice cream) and 12,000 eggs. Asians consume about 1/4 the sugar and "only" about 500 pounds of meat, fish and eggs combined. (*East/West Journal*, November 1982.)

A study on meat consumption gave the following figures: New Zealanders consumed the most meat worldwide—about 229.1 pounds of meat per person in 1982. The United States was second with about 222.2 pounds per person. We have already discussed how vegetarianism can help in alleviating world hunger—again, cropland would be used directly to feed the people, not indirectly to feed animals to feed people. We have seen that people are frugivorous by nature, and so land used for animals as food is both wasteful and contrary to our biological heritage (to say nothing of cruel, as far as the use of animals for food is concerned).

In the middle of the earth's bounty, over a billion of us—that is *1 out of 4 members of the human family*—go hungry. Fifteen to twenty million of us die from hunger every year. That is 41,000 of us each day, 28 of us every minute, 21 of us children. In Africa alone, 4 million children may die this year and next from starvation and malnutrition. Humanity has never lived without hunger, its oldest and most lethal enemy. Ours is the first generation that has ever had the possibility of calling forth a world in which hunger may be ended. What is lacking is not technology, but the individual and global will to take necessary actions to preserve human lives and our precious environment. Meanwhile, while 1 of 4 of us go hungry, and 41,000 of us die daily from hunger, at least dogs with wealthy owners on the Cote d'Azur in France are getting by. A news item (May 14, 1984) reports that a gourmet restaurant for dogs featuring 3-course meals costing up to \$15 and "served on real china" just opened recently. (I read of a similar restaurant in New York a few years back.) The restaurant offers a selection of cheeses from Holland and France, elaborate main courses, and a pastry cart. Some examples of the plat du jour are "a selection of beef filet with artichoke," or "fish mousse with skimmed milk and fresh green beans." The

dogs are served by white-coated waiters "under the supervision of a veterinarian, a profession dog handler, and a dietitian." It used to be that *dogs* were thrown table scraps, but perhaps now a few starving people could apply for jobs as waiters there and hope for a few table scraps themselves! Fifteen dollars would buy dinner groceries for a whole family, if this family were "worthy" enough to receive the same generosity bestowed upon these dogs.

The World Conservation Strategy was published by the International Union for the Conservation of Nature, and was the result of three years of research and discussion involving more than 450 government agencies and over 100 countries. It was "launched" on March 1980, in London and 32 other capital cities across the world. A summary of the strategy appears in the April 1980, *Not Man Apart*. However, it fails to recognize the naturally-retrogressed and humanly overexploited state of the biosphere and of the present late-interglacial soil, and does not emphasize remineralizing soils, reforesting large areas or establishing biomass energy plantations, or restoring the earth's poverty-stricken ecosystems. It is more concerned with "conserving" than *rebuilding*, but does say that most countries are too poorly organized even to *conserve*, that severe soil degradation is already a critical problem, that deserts could soon adversely affect 630 million people, that tropical forests were quickly becoming extinct—and that time was "running out." Because there is less and less to conserve in the first place, nowadays, it is now imperative that we *rebuild* our environment, while there is still some time left to do so. Conservation *alone* is not enough.

These times are characterized by a great awakening of the human force all over the planet, as more and more people become more and more conscious of the human potential for higher evolution. This is seen in the many popular movements, grassroots communities and local organizations that are flourishing everywhere. This world force is a new kind of leadership that can unify the expressions of groups and organize for action. Leadership from, and of, the group—and from the "least" among us—is the hope for change in our time!

The elimination of poverty is the ethical issue of our time, said John Sewell, President of the Overseas Development Council (Washington, D.C.), who says, "some 100 or more years ago, the idea that trade in human beings should be abolished was one that struck reasonable and rational observers as a political impossibility, yet that issue became the moral problem of that time, and eventually trade in humans was stopped. And I would guess that my children will wonder why we are not about our task faster in the last part of the twentieth century, when we have both the knowledge and the wherewithal to deal with global poverty."

R. Buckminster Fuller devoted his attention to the need for integrity in the world in the last months of his life, before he died at 87. "Human integrity," he said, "is the uncompromising courage of *self* determining whether or not to take initiative, support, or cooperate with others in accord with all the truth and nothing but the truth as it is conceived of by the divine mind always present in the individual."

As of 1983, 73 countries have "ended" hunger, at least as a basic, society-wide condition. This was true of no country on the planet in the year 1900. By 1940, it was true of only nine. It is clear that the individual—each one of us—is the key to realizing these, and future, achievements. When famine struck Biafra in the late 1960s, \$6 million was raised in the U.S. for relief. It took more than a year. But in March 1980, \$42 million was raised in only five months to aid Cambodia. On a global level, the growth in responsiveness to emergencies has been equally dramatic, and today, world response to emergencies is faster, more generous—and more effective, when it begins with the assumption that the purpose of aid does not end with temporary relief, but that its purpose is to find the resources for food-sufficiency within the situation. Recently, a Canadian nongovernmental organization called Inter Pares ("among equals") invited Third World farm leaders to live with their Canadian hosts; they had joint meetings and worked out solutions to mutual production problems. Successful education projects in every industrialized country show the same truth: *We share one planet and our opportunity is to succeed together or not at all.*

Crop yields are usually assumed to be continually increasing, but former USDA researcher Lester

Brown documented that chemically-induced yields were falling or leveling off in the U.S., China, France, and elsewhere (*The Worldwide Loss of Cropland*, 1978, Worldwatch Paper No. 24). Pollution by pesticides and fertilizers, and potential deterioration in climate or weather, are not taken into account when predicting higher crop yields. Brown says that major improvement in the food supply for the world's poorest populations isn't likely if things continue as they are, and what improvements do occur "will require an increase of 95% in the real price of food." (p. 415). Those who think that today's agricultural methods will increase crop yields in the future also think that food production will only increase fast enough to meet rising demands if world agriculture becomes "significantly more dependent on petroleum and petroleum-related inputs" (again, this would increase the real price of food over the 1970-2000 time period), but it is obvious for *ecological* reasons that it is now time for a world transition *away* from petroleum dependence, though it is uncertain how this will occur.

Meanwhile, farmer's costs of raising and maintaining yields have increased rapidly; yields will increase more slowly than projected. These yields also assume a (roughly) 180% increase in fertilizer use. These fertilizer projections are intended to apply to a full package of "yield-enhancing inputs," including pesticides, herbicides, irrigation, etc. Not enough emphasis is being placed on the fact that *there are only 2 1/2 inches of the original glacial deposit left in the topsoil, and there is no more on the way up*. (We'll talk more about this later.)

Because we have not fully recognized the natural operational principles of the earth's ecology, and applied these principles in the key areas of our lives, we have brought ourselves to the point where we must now courageously face the *totality* of our problems.

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2. The Quality Of Our Food Is Determined By The Quality Of Our Soil

2.1 Mother Earth: Our Soil and Giver of Life

2.1.1 Soil Structure

Good granulation or crumb structure of the heavier soils is essential for good results. Sandy soils show little if any granulation, because their particles are coarse. With soils containing a substantial percentage of clay, working them when wet results in destruction of the granular structure. Tillage also tends to break down the structure of many soils. Alternate freezing and thawing, or wetting and drying, and penetration of the soil mass by plant roots are natural forces that favor the formation of soil granules, or aggregates. Such aggregation is developed most highly in soils near neutrality in their reaction; both strongly acid and strongly alkaline soils tend to run together and lose their structural character. (*Organic Gardening*, Rodale.)

2.1.2 Porosity

Pore spaces may be large, as with coarse, sandy soils or those with well-developed granulation. In heavy soils, with mostly finer clay particles, the pore spaces may be too small for plant roots or soil water to penetrate readily. Good soil has 40-60% of its bulk occupied with pore space that is filled with either water or air. Too much water slows the release of soil nitrogen, depletes mineral nutrients, and hinders proper plant growth. Too much air speeds nitrogen release beyond the capacity of plants to utilize it, and much is lost. (*Organic Gardening*, Rodale.)

2.1.3 Soil Groups

Sandy soils: Gravelly sands, coarse sands, medium sands, fine sands, loamy sands

Loamy soils: Coarse sandy loams, medium sandy loams, fine sandy loams, silty loams, stony silt loams, clay loams

Clayey soils: Stony clays, gravelly clays, sandy clays, silty clays, clays

Sand particles are gritty; silt has a floury or talcum-powder feel when dry and is only moderately "plastic" when moist, while the clayey material is harsh when dry and very plastic and sticky when wet.

As we said, the ideal structure is granular, where the rounded clusters of soil lie loosely and shake apart readily. (*Organic Gardening*, Rodale.)

2.2 Erosion

Soil erosion rivals oil dependency as a threat to the economic progress of the world, according to a report issued in February 1984, by the Worldwatch Institute. "Under pressure of ever-mounting demand for food, more and more of the world's farmers are mining their topsoil, and soil erosion has now reached epidemic proportions; its effect on food prices could ultimately be more destabilizing than rising oil prices." Half of the world's cropland is losing topsoil faster than nature can replenish it. In the Soviet Union, an estimated half-million hectares of cropland are abandoned yearly because they are so severely eroded by wind that they are no longer worth farming. (*State of the World—1984*, Worldwatch Institute's analysis of global trends.) The report paints a grim picture for other resources, including forests and water supplies.

The main loss of soil occurs by sheet erosion, that is, each time it rains, the runoff water removes a thin layer of surface soil. As the topsoil becomes thinner, miniature gullies appear. After most of the surface soil is gone, gullies become the main problems.

There is usually a clear difference between topsoil and subsoil. Subsoil is finer textured, more plastic, and lighter in color than topsoil. Erosion is classified as follows:

No apparent erosion. All or nearly all surface soil is present. Depth to subsoil is 14 inches or more. The surface may have received some recent deposits as the result of erosion from higher ground.

Slight. Depth to subsoil varies from 7 to 14 inches. Plowing at usual depths will not expose the subsoil.

Moderate. Depth to subsoil varies from 3 to 7 inches. Some subsoil is mixed with the surface soil in plowing. *Severe.* Depth to subsoil is less than 3 inches. Surface soil is mixed with subsoil when the land is plowed. Gullies are beginning to be a problem.

Very Severe. Subsoil is exposed. Gullies are frequent.

Very severe gullies. Deep gullies or blowouts have ruined the soil for agricultural purposes. (Rodale Press.)

There is a direct relationship between erosion and a soil's ability for intake of air and water. When the soil surface becomes compacted, the danger of erosion increases, while the intake of water and air decreases.

Agriculture Department programs have been under heavy criticism because of severe erosion problems nationwide. One recent federal report said erosion was increased by the payment-in-kind program (which paid farmers who had surplus grain for *not* growing more) because many participants who were required to plow up fields to qualify for the program did little to protect the soil. In addition, congressional critics have charged that farmers were putting more of their fragile farmland into production to boost their acreage in government programs.

Overoxidation of humus by tillage exposure also increases CO₂ in our atmosphere. Tillage exposure

permits the oxidation that releases carbon to the air and, simultaneously, decreases the carbon storage the humus provides in the soil mantle. Forests conduct more photosynthesis worldwide than any other form of vegetation. *Photo-synthesizing plants are our source of oxygen.* When we harvest forests, extend agriculture onto soils high in organic matter, and destroy wetlands, we speed the decay of our precious humus heritage (Lesson 50).

Some soil scientists say that under the best conditions nature can build topsoil at a rate not faster than 1.5 tons per acre each year, and under some conditions, the rate is only .5 tons per acre per year. About 2/3 of U.S. cropland is experiencing a net loss of topsoil. From water-caused erosion (and wind erosion, such as on the Great Plains) we are losing topsoil, on the average, five times faster than nature can build it, even under the best conditions.

Soil conservationist Neil Samson explains the problem in his 1981 book *Farmland or Wasteland*. He says to think in terms of the acre-equivalents of farmland productivity we lose each year through erosion. Losing a thousand tons of topsoil on one acre—equivalent to six inches of soil— would destroy the productivity of most cropland. He says that well over one million acre-equivalents of farmland productivity are lost yearly. Over 50 years, this could amount to 62,000,000 acre-equivalents.

The government estimates that 43% of land planted in row crops in the Corn Belt is highly susceptible to erosion; plowing up fragile soils that should have remained pasture and will only produce a few harvests is like the "slash-and-burn" technique of jungle agriculture.

Most conventional farms in the Corn Belt grow corn and soybeans year after year, without the rotation with small grains and legume hay so important to the organic farmer. In addition to nutrient building, these crops help to reduce erosion by covering the ground with a living mulch and binding the soil with their roots, thus protecting the fields from the destructive forces of rain and wind that are destroying American cropland faster than at any time during our history.

Corn and soybeans have brought the best price in the export markets, but these two crops are linked to the highest rates of soil erosion. Planted in rows, they leave part of the soil exposed, unlike grasses or clover which cover the ground entirely. Soybeans have shallow roots that also leave soil more susceptible to erosion. Crops of small grains (oats, barley) and hay (alfalfa) have less cash value, but these crops are grown close together—this reduces surface water runoff and erosion. Because many farmers plant the same crops each year instead of rotating them or letting the earth lie fallow, the soil further loses its ability to rebuild itself. Chinese farmers have tilled the same land for at least 40 centuries. In America, farmers may wish to conserve the land they farm, but the economic forces at work do not "reward" soil conservation in the short term, so many farmers do not invest in soil conservation.

2.3 Farming in the United States Today

The United States currently exports one-third of its annual agricultural harvest, growing enough to feed about 240 million Americans, plus 120 million people abroad.

In 1980, the Rodale Press initiated the Cornucopia Project to document where the U.S. food system is vulnerable and to suggest how it could be transformed into one that maintains high productivity and also conserves its resources. The book *Empty Breadbasket?* is a report on the results of that study. Here are some of its findings:

- The size of the average U.S. farm has tripled since 1920.
- In 1978, 1% of farm owners controlled 30% of the land.
- The average molecule of processed food travels 1,300 miles before being eaten. (One of the first things I remember hearing in my transition to natural foods was that it is considered better to eat foods that are grown within several hundred miles of where one lives, the logic being that foods native to the area, those surviving in the climate where one lives, contain the nutrients best suited to maintain health in the climate of the particular area. Of course any food that is *fresh* is

certainly *always* superior to any processed—or sprayed, or otherwise altered—food, and contains more vitamins and nutrients, but all other factors being equal, you might want the *bulk* of your diet to consist of fresh foods local to your area, if you are able to obtain fresh, organic produce that is grown close to home, with nonnative foods used to *supplement* your diet.)

- Every year, enough topsoil is eroded to cover to a depth of one foot Maine, New Hampshire, Vermont, Connecticut and Massachusetts.
- About 15% of American cropland is irrigated—and on that land is raised 25% of the total value of U.S. crops. An estimated 25% of the groundwater used is being removed faster than it is replaced.
- America's farmers use an average of two pounds of pesticide and 120 pounds of synthetic fertilizer per acre of cropland per year. These chemicals lead to contamination of soil and water, destruction of wildlife populations and health problems for soil workers.
- It takes 10 times more energy to produce a calorie of food today than it did in 1910.
- In short, the study concludes that the U.S. agricultural system is productive but not sustainable, either economically or ecologically.

Much farmland is lost to urban growth, as cities spread; as the cash value of their land increases, some farmers sell to developers.

When the prairie grasslands were turned and plowed, a long line of ecosystems (that stretched back 30 million years) was broken. It had been a wilderness that supported migrating water birds, animals, *and* the native Americans. In the short run, the European crops grown by the "new" Americans would out-yield the old prairie, but they were not looking ahead. We have discussed over and over the intricate workings of the body, and how interference with nature's ways eventually distorts these workings. Imposing manmade chemicals on our systems, and altering our natural bodily rhythms by improper lifestyles, disturbs our balance. The new farmers forgot one important fact: the prairie is a *polyculture*. Crops are usually grown in monocultures. Whereas the prairie has many perennial plants, agriculture relies heavily on annuals, but species *diversity* is the key. There are millions of microscopic life forms, and nature prefers polyculture, not annual monoculture. We are also gambling foolishly with our chemical fertilizers, for if we could see on a microscopic level, we would see that life is much more intricate than a few calculations and "fertilizer" additions. Mechanical disturbances of the prairies, and chemicals, may make "weed control" effective, but the farm will be weakened in the long run as, soil compacts (increasing erosion), crumb structure declines, soil porosity decreases, and the loss of a "wick effect" (of pulling moisture down) lessens. Monoculture decreases the range of invertebrate and microbial forms. Even crop rotation doesn't give enough diversity when compared to the greater diversity that was in the prairies originally, and monoculture results in the loss of botanical (and thus chemical) diversity above ground. Plants are weaker and invite insect pests or disease. (Insects are also better controlled if they have to spend some energy looking for the plants they evolved to eat among *many* species of polyculture.)

Organic farming methods attempt to take more of nature's plans into consideration, and work *with* nature, not against it. There are an estimated 30 to 50 thousand organic farms in the U.S. When Chinese farmers were forced to move south and east because of deforestation and destructive agricultural practices, they had to relearn how to farm. For 40 centuries Chinese peasants have been developing a culture that survives because it return everything to the land.

2.4 Poverty and Hunger at Home

A report in January 1984, showed that demand for emergency food or shelter increased in the United States last year in 95% of the cities surveyed, despite an improving employment picture in 70% of the cities. Even in America, there are thousands of homeless people who sleep in streets, alleys and abandoned cars. Chicago estimates that there are 25,000 people in their city alone who "don't even have a ragged hut or camping tent to call their home—an indictment of us as a people," says the mayor.

President Reagan's task force on food assistance announced in January that it could find no evidence of "rampant hunger" and saw no need for new assistance programs. But the Citizens Commission on Hunger in New England said its Harvard-based members and staff conducted five months of field investigation and reviewed every public and private study of hunger in the United States done since 1980 to support their statements about the national dimensions of the problem. Their report calls on Congress to increase funding for federal programs that affect hunger, saying that all the evidence gathered showed an increase in poverty and hunger over the past five years, and that hunger in America is no longer confined to the traditional poor or to ethnic minorities—they have been joined by other Americans who were not poor and not hungry several years ago. The hardest hit are poor infants and young children, the elderly, (especially those on fixed incomes) and families with an unemployed breadwinner.

2.5 Is Big Really Better?

Now that so much of our nation's farming is done on a larger scale than ever, with more complex machinery, can we expect a better food product at the end of the line? Sad to say, we pay in more ways than one for "progress," and we pay the most dearly when the end result of food processing is a drastic decline in nutritional quality. Even the *best* our supermarkets have to offer—fresh produce—is less tasty and healthful than organically-grown, sun-ripened produce. Anyone who has ever eaten both a commercially-grown strawberry and a sweet, juicy homegrown one, sun-ripe, can tell you about the difference in taste. Anyone who has eaten a vine-ripened tomato will cringe at the watery tastelessness of green-pulled tomatoes so common in supermarkets—there is simply no comparison. This is *aside* from the obvious advantage that organic produce is free from pesticide residues.

As to *processed* foods, we've discussed all their negative aspects in detail in earlier lessons and are by now quite familiar with them.

A 1983 newspaper article on food additives reads like this:

"Let's say that you ate bacon and eggs for breakfast, with a muffin and jam on the side."
(Let's hope you *didn't*, but to continue ...)

"For lunch, you downed a hamburger with ketchup, some pork and beans and a cola. And for dinner you munched on tossed salad with Caesar dressing, gnawed on barbecued ribs and french fries and slurped ice cream with butterscotch syrup for dessert."

"That feast would have filled your belly with about *150 food additives*, many with frighteningly unpronounceable names—jawbreakers unknown before scientists started fiddling with food in the post-World War II era."

Still, the chemical companies try to save face by constant efforts to convince the public that only "safe" additives are used in food. Recently I saw a pamphlet put out by Safeway Foodstores entitled "Additives: Why Are They In My Food?" and I couldn't resist the temptation to hear what sales-pitch they'd come up with! Let's take a look:

- First of all, "additives make it possible for the shopper in the family to do the shopping only once or twice a week." (I manage to do this while just eating fresh foods, but we'll go on ...)
- "Additives keep our food, supply fresh and consistent." (*Unspoiled*, perhaps, but *fresh*?)
- "No longer is it necessary to slave over a hot stove, all day, every day." (No problem there for us raw fooders.)
- However, the statement that really caught my attention, lightly stated and casually tossed in there with all the others, leaving me with a somewhat eerie feeling, was: "And, if we all wanted fresh, there just wouldn't be enough to go around."

Is that the good news or the bad news?

2.6 The Fox is Guarding the Chicken Coop

The pamphlet goes on to tell us, among other things, that "in 1971 the Food and Drug Administration (FDA) began to review all 'Generally Recognized as Safe' (GRAS) additives. Most of the substances which have passed through this screening process have been reaffirmed as safe and remain on the list." (Those that aren't were undoubtedly consumed by countless unfortunate individuals until this point.) "Substances not listed as GRAS and substances new since the 1958 Food Additives Amendment must be safety-tested under the manufacturer's auspices and approved by the FDA. Manufacturers submit the results of all of their tests to the FDA. If they indicate the additive is safe, the FDA establishes regulations for its use in food." Are we really to believe that the *manufacturers* of these chemicals can be trusted to keep our best interests in mind if they are "safety-testing" their *own* additives? We can be sure that the *safest* foods are foods with *no* additives at all: fresh, raw foods, as nature delivers them to us.

A final note on ethics, or *lack* of ethics, as the case may be (excerpted from *Acres U.S.A.*, May 1984):

It was discovered that "the International Biotest Laboratories in the United States had falsified results of some long-term pesticide tests so that some pesticides may have appeared to be less hazardous than they really are (though the company shredded records after the scandal broke). The scale was large: in about 10 years IBT did more than 20,000 tests for some 200 companies, and was responsible for about 1/3 of all pesticide toxicity and cancer testing done by government and industry."

Please review "The Case Against Commercially-Grown Foods," of Lesson 49.

2.7 Demineralization of Soils Worldwide

In Lesson 49, nutrient contents of organically-grown foods are compared with those of chemically-grown foods, and it was found that the foods grown by organic methods had higher contents of nutrients, as well as better flavor.

In the summer of 1977 a corn crop was grown on soil that was mineralized with glacial gravel crusher screenings, and tested with corn from the *same* seed grown with chemical fertilizers. The gravel-mineralized corn had 57% more phosphorus, 90% more potassium, 47% more calcium, and 60% more magnesium than the chemical-grown corn. The mineral-grown corn had close to 9% protein, which is good for a hybrid corn, and all the nitrogen in the mineral-grown corn (whose content in the food is the indicator for protein) came from the atmosphere by biological processes and was in the amino acids of the corn protoplasm. None of it was raw chemical nitrate, the precursor of the carcinogenic nitrosamines. No pesticides were used and there was no insect damage.

Microorganisms can reproduce abundantly only when all minerals are present, along with plant residue to supply carbon needs for energy and protoplasm compound building, plus nitrogen, oxygen and sea solids from the air, and (of course) water.

The chemical-grown corn of 1977 had substantially less mineral content than corn listed in the 1963 USD A Composition of Foods Handbook of nutritional contents of foods, but the mineral-grown corn of 1977 was substantially *higher* in mineral content than the 1963 Handbook's corn. Most people are now consuming food with less mineral content, and then further destroying what nutrients are left by processing, cooking and otherwise altering food. Then, with improper eating habits, overeating, bad food combinations, and so on, they reduce the value of their food even *further*.

Firman Bear of Rutgers University did a study on trace element contents of vegetables, published in the 1948 *Soil Science Society of America Proceedings*. His study shows the significant fact that foods that may *look the same* actually have huge variations in mineral content, and thus their health-promoting

value. A chart summarizing his findings was reproduced in *Acres U.S.A.* (1977), as follows:

In a 1977 paper, John Hamaker compared Bear's data with the USDA's 1975 reprint of the 1963 *Composition of Foods Handbook*. He says that the Handbook only gives data for a single trace element (iron) and says: "but it is a very significant element. A comparison on a part-per-million basis with Bear's highest and lowest, followed by the Handbook average, is as follows: snap beans 227, 10 and 8; cabbage 94, 20 and 4; lettuce 516, 9 and 14; tomatoes 1938, 1 and 5. In the Bear study, if one trace element is low in all vegetables, then all the other trace minerals are low. Therefore, the *average* of these vegetables in 1963 were no better supplied with trace minerals than the lowest in 1948. It has been 14 years (now, in 1984, 21 years) since the 1963 studies. The USDA ought to have upgraded its information and included much more trace element information. Instead, they copied the old 1963 Handbook tables and put them out in a fancy new cover in 1975. An honest set of figures on trace elements would show a lot of zeroes on a part-per-million basis and would damn chemical agriculture for the monstrous fraud it is. All of our food should be as good or better than the best found by Firman Bear. Such standards can be and must be obtained very quickly if we are to survive."

A September, 1980 letter from the USDA said, in part, "Revised sections of Agriculture Handbook No. 8 covering cereal grains and grain products, fruits, vegetables, legumes, nuts and seeds are all underway, with publication dates scheduled for 1981-1982." It would be interesting to see what these revisions reveal, and if they are, indeed, *honest*.

The United Nations Food and Agriculture Organization (FAO) Soils Bulletin No. 17 is entitled *Trace Elements In Soils and Agriculture*, dated 1979. It gives data similar to Bear's in showing the wide variations in extent of soil mineral depletion. It notes the biologically-essential nature vitamin "therapies." We have discussed the futility of using "supplements" in earlier lessons.

Variations in Mineral Content in Vegetables

	Percent- age of dry weight	Millequivalents per 100 grams dry weight					Trace Elements parts per million dry matter					
		Total Ash or Min- eral Mat- ter	Phos- phorus	Calc- ium	Magnes- ium	Potass- ium	Sod- ium	Bor- on	Mangan- ese	I- ron	Copper	Co- balt
SNAP BEANS												
High- est	10.45	0.36	40.5	60.0	99.7	29.1	73	60	227	69	0.26	
Low- est	4.04	0.22	15.5	14.8	8.6	0.0	10	2	10	3	0.00	

	CABBAGE											
High- est	10.38	0.38	60.0	43.6	148.3	53.7	42	13	94	48	0.15	
Low- est	6.12	0.18	17.5	15.6	20.4	0.8	7	2	20	0.4	0.00	
	LETTUCE											
High- est	24.48	0.43	71.0	49.3	176.5	53.7	37	169	516	60	0.19	
Low- est	7.01	0.22	6.0	13.1	12.2	0.0	6	1	9	3	0.00	
	TOMATOES											
Highe st	14.20	0.35	23.0	59.2	148.3	58.8	36	68	1938	53	0.63	
Lowe st	6.07	0.16	4.5	4.5	6.5	0.0	5	1	1	0	0.00	

Voison looks at the relation of cancer to soil depletion and imbalance in *Soil, Grass and Cancer: Health of Animals and Man Is Linked to the Mineral Balance of the soil* (1959). According to Voison, "the dust of our cells is the dust of the soil," and "animals and men are the biochemical photograph of the soil."

Trace Elements in Plant Physiology (Wallace, 1950) says that the relation between cancer and the soil may be readily understood by a look at the four types of cell processes known to be subject to the balance of trace elements:

1. synthesis and breakdown of tissue structures.
2. energetic processes ("oxido-reductions").
3. regulation of nervous stimuli.
4. detoxification of cellular poisons.

These processes refer to the actions of about 5,000 soil-dependent enzyme systems, all of which can be disrupted or prevented by element deficiency, imbalance, or drugs, pesticides, radiation, etc. (Knight, 1975.)

Billions of dollars a year are spent on efforts to "find 'cures' for cancer," but very little, if anything, is spent on efforts to remineralize the soil and save it from chemical abuse! With the same money used

yearly for cancer "research" about *15 million* doctors could obtain a round-trip ticket to the Hunza region, to observe the peoples' good naturedness and superior health. How many doctors *really* want to learn why the ten-bed hospital for about 40,000 Hunzakuts is practically empty all the time? How many "researchers" would be out of a job if people learned how to *prevent* sickness and had no for "cures"?

Schauss, an experienced criminologist, counselor and director of the Institute for Biosocial Research says:

"Eskimos and Native Americans living in very remote territories on indigenous food supplies in the Stewart Islands of Alaska, who had been physically and psychologically healthy for centuries, experience the degenerative diseases and moral decay so prevalent in western culture when the foods (not specified) from that culture are allowed in. Crimes are subsequently committed for which these 'primitive' cultures didn't even have words in their language to describe; the words had to be *invented*."

As we said, virtually all of the subsoil and most of the topsoil of the world have been stripped of all but a small quantity of elements. In the Hunza region of the Himalayas many people live to a fine old age and stay healthy and vigorous. The valley's soils are irrigated with a milky-colored stream from the meltwater of the Ultar glacier. The color comes from the mixed rock ground beneath the glacier. Ten thousand years ago the Mississippi Valley was fed and built up by runoff from the glaciers. Illinois had a deep deposit of organically-enriched alluvial soil that resulted in a long period of luxuriant plant growth, but when the settlers plowed the valley, they didn't find topsoil that would give the health record of the hunzakuts. Ten thousand years of leaching by a 30-inch mal rainfall is the difference. There are several other places in the world similar to Hunza, such as the Caucasus Mountains in Russia, where 10% of the people are centenarians. There are glaciers in the mountains. Wherever people attain excellent health and maximum life, there is a continual supply of fresh-ground mixed rocks flowing to the soil where their crops are grown.

Robert McCarrison (Director of Nutrition Research in India years ago) did extensive studies on nutrition, health and deficiency-diseases. After observing the magnificent bodies of the people of the Hunza Valley, their sound teeth, strength, longevity, intelligence and happy dispositions—human health almost to perfection—he gave Albino rats the diet of the Hunzas. Then he gave other colonies of rats the diets of disease-ridden cultures on the Indian Sub-Continent. He found that the rats would duplicate the health of the people eating the diets: perfect health and contentment on the Hunzas' food, and the disease of the Madras on the Madras food.

Working seven years among the Hunzas and Sikhs, both good gardeners and farmers, he never found a case of stomach ulcer, appendicitis or cancer. It was his finding (*already in 1936*) that: "it seems clear that the habitual use of a diet made up of natural foodstuffs, in proper proportion one to another, and produced on soils that are not impoverished, is an essential condition for the efficient exercise of function of nutrition on which the maintenance of health depends," and combined with healthy bodily activity, "is mankind's main defense against degenerative diseases; a bulwark, too, against those of 'infectious' origin."

In 1948, J. I. Rodale, the well-known organic agriculturist, published *The Healthy Hunzas*, which revealed how the world's healthiest people annually add to their soils the mixture of stones finely ground by the local Ultar glacier, together with the abundant organic matter produced by these highly-mineralized soils. (Little animal manure is added as the Hunzas keep few animals.) Rodale stressed the great value of adding the wide variety of rock to soils in a "ground-up, flour-like form" by using the most efficient modern machinery (p. 100). He also pointed out the danger of adding imbalancing single-rock types, and concluded his chapter, "Rock Powders," by giving major credit for the Hunzas' outstanding health, longevity, and intelligence to the glacial rock powder, their provision for perpetual soil fertility, and high-quality foods. Rodale was emphatic that we in the United States *begin to utilize the billions of tons of rocks of all kinds, and apply them—equivalent of the Hunza sediments—to our*

lands, in a powdered form.

Sir Albert Howard, (often called "the father of organic agriculture") also described the Hunzas in his 1947 book *The Soil and Health*, and he too observed the Hunza Valley's glacial silt fertilizer, and the powerful evidence suggesting that "*to obtain the very best results we must replace simultaneously the organic and mineral portions of the soil.*"(p. 177)

In the next lesson when we continue to tie in the links between soil demineralization and climate changes, we'll be talking about the Ice Age. Scientists have offered various theories on what causes the ice ages to recur every 100,000 years, and many of them used to think that they were caused by changes in the earth's orbit around the sun (Milankovich's theory). Recent computer modeling (by a man who has been the foremost modern exponent of this theory, John Imbrie at Brown University) has finally cast serious doubt on the validity of Milankovich's hypothesis, because Imbrie says that the most sophisticated recent of the minerals for health of soil-building microorganisms, plants and humans, and says that widespread deficiencies now exist. Soil zinc deficiency is documented for 12 European countries, as is boron for nearly every European country. It also makes note of the danger of trying to correct soil deficiencies by adding purified single elements, due to their toxicity (for example, boron has been used as a weedkiller).

Nowhere is soil *remineralization* considered in the bulletin, but it does say that generally from two to six times more of the main nutrients are taken annually from the soil than are added by mineral fertilizers. Crop and manure residues return some of them, but a negative balance of these nutrients likely remains.

As for trace elements, on page 1, the FAO soils bulletin says that deficiencies in these elements were first reported in the late 1800s, and that extensive areas of the earth's soils are no longer able to supply adequate amounts to plant life.

Furthermore, several factors are causing an *accelerating* exhaustion of the available soil supply:

- weathering and leaching
- stimulation of increased yields by one-sided NPK fertilizing
- decreasing use of natural fertilizer materials compared with chemicals
- increasing purity of these chemicals used to stimulate growth

The bulletin doesn't provide any solutions, but it does state the problems that need solutions, saying "trace elements are not regularly applied to the soil by the use of the common fertilizers. Their removal from the soil has been going on for centuries without any systematic replacement." (p. 1).

In Mount's *The Food and Health of Western Man* (1975) he said that 66% of American college women had low-to-absent iron stores. The 2nd World Symposium on Magnesium held in Montreal in 1976 said there was "a grave danger of magnesium deficiency in foods consumed in the developed countries." *The Ecologist* (12/79, p. 317) said that "cancer, arteriosclerosis, and heart and bone diseases are implicated as resulting from such deficiencies." A 1979 South African study showed 89% of the cancerous regions had poor soils, whereas 66% of cancer-free regions were on comparatively rich soils. (Life Scientists know that there are other factors involved as well, such as improper lifestyle and eating habits, exposure to environmental toxins, and so on, but these studies also point to factors as basic as the soil itself as contributing to dwindling health.)

Trace Elements in Soil-Plant-Animal Systems (Nicholas, 1975), shows continuing findings by researchers of "new" essential elements for human health, and shows that deficiencies can be expected to result in breakdown of the physiological functions where the element is involved. They say that there are now 14 known trace elements essential for animal life, and most or all of them are essential for soil microorganisms as well. In order of their discovery as essential, they are: iron, iodine, copper, manganese, zinc, cobalt, molybdenum, selenium, chromium, tin, fluorine, silicon, nickel and vanadium; also boron for "higher plants."

Weston Price wrote a book entitled *Nutrition and Physical Degeneration* (1945, 1975) that gave his

findings from many years of studying people of cultures and lands worldwide. He proved how *rapidly* individuals and entire peoples degenerate physically, mentally and morally when their diet changes from natural whole foods from fertile soils to the refined and nutrient-poor foods of modern societies. Price was a dentist by training, and found, among other things, that people suffering from tooth decay were ingesting deficient amounts of vitamins and less than half the minimum requirements' of calcium, phosphorus, magnesium, iron and other elements. He also said severe malnutrition was a primary cause of juvenile delinquency and violent criminal tendencies.

In his chapter "Soil Depletion and Animal Deterioration," he says:

"In my studies on the relation of the physiognomy of the people of various districts to the soil, I have found a difference in the facial type of the last generation of young adults when compared with that of their parents. The new generation has inherited depleted soil ... The most serious problem confronting the coming generations is this nearly insurmountable handicap of depletion of the quality of the foods because of the depletion of the minerals of the soil." (p. 392)

We might note that this serious problem was being talked about almost *40 years ago*.

Metabolic Aspects of Health: Nutritional Elements in Health and Disease by John Myers, M.D. and Karl Schutte, Ph.D. (1979) also stressed the widespread incidence of soil mineral deficiency; the innumerable forms of diseases brought on by these deficiencies, including psychobiological imbalances; that dozens of known human enzyme systems are absolutely proven to be keyed to soil elements, including zinc, boron, cobalt, manganese, barium, nickel, copper, magnesium and more; and the great need for the natural balance of these elements via the food supply. Schutte, the botanist, shows that the same principles apply for health disease/insect-resistant plant growth.

The exact relations between the many soil elements and cancer, atherosclerosis and hypertension haven't been defined, but Myers and Schutte say that it is now clear that they can also be associated with imbalances in the trace elements supply, which keys the normal enzymatic activity of the cell. (p. 193)

The Hunzakuts are virtually free of cancer, but in the U.S., one out of every four people will develop cancer in their lifetimes (Eckholm and Record, 1976). Gus Speth, Chairman of the Council on Environmental Quality, announced in 1980 that the incidence of cancer rate jumped by 10% from 1970 to 1976, whereas from 1960 to 1970 it "only" increased 3%. *Science News* (vol. 110, p. 310) says: "Diet can have a dramatic influence on the prevention and treatment of cancer." (How long have *you* and *I* been saying this?) He goes on to say that "spontaneous regression of cancer, for instance, appears to have resulted from a change in the balance of trace elements."

Remember, there is a difference between getting these trace elements naturally in foods and trying to manipulate the body through all manner of haphazard, random version of the Milankovich theory (Imbrie's) is capable of explaining only the smaller, climatic changes associated with minor fluctuations in glaciation, and these, only for the past 150,000 years or so—beyond about 350,000 years it seems to have little value in predicting any of the climatic changes we now know about. So with astronomical causes more or less ruled out, the great ice age cycle must be caused by something here on earth. This is where John Hamaker comes in.

John Hamaker was trained in mechanical engineering at Purdue. He became interested in climatology only after thinking about the environment for many years, watching it deteriorate from neglect and abuse. He got first-hand information on the danger of toxic chemicals while working as an engineer for Monsanto in 1940 (we'll mention Monsanto again later, so we can make a mental note of the name), long before the rest of us got the bad news from Silent Spring. After serving in the army for five years during WWII and coming out a captain in the reserve, he went to work designing oil refinery machinery in Texas. But he began to feel sicker and sicker, and realized that he had to get out of that toxic environment.

He bought a farm in east Texas, and "learned about really worn-out soil—and the mess that chemicals make on farmland." He noted that his cows kept as far away from agricultural chemicals as they could, and wondered if they were smarter than people. Later he moved to Michigan, where he is now retired. For many years he has been doing experimental work on a ten-acre farm outside of Lansing.

During the late 1960s, while thinking about big questions like the health of the soil and man's relationship the earth, he began to read every book and scientific tide he could get his hands on about climate and soil and the health of plant life, and he believed he then understood what causes the ice ages to come and go with such predictability.

Why, he had wondered, are the winters getting colder, the summers hotter and drier, the storms and tornados increasingly frequent with every decade? What forces on earth are large enough to cause such global changes?

When he looked at these steeply rising curves, another curve came to mind: the exponentially rising curve of carbon dioxide (CO₂) in the earth's atmosphere. This CO₂ is well-known (we'll talk more about this too in the next lesson), and many scientists link it to the greenhouse effect that traps warmth radiated off the earth from the sun and increases the temperature all over the globe, but there is no consensus as to when this global greenhouse effect could be large enough to cause such changes. In spite of the very large increase of CO₂ that has already occurred, the earth seems to be in a *cooling* phase in recent decades (more details next lesson).

Apparently Hamaker saw what no one else did: that the greenhouse effect is occurring *differentially*—primarily in the warmer latitudes, which get the most sunlight (the poles don't get any sunlight for six months out of the year, and very oblique rays the rest of the time), and that the pics have *already* been heating and drying up for the last few decades, that consequently the northern latitudes have been getting colder and wetter, and that the increasing temperature differential between the two has taken on a life of its own and is accelerating the whole process.

John Hamaker tells us:

"I have observed the things of the world for almost 66 years. The luck of the genes equipped me to observe and learn. I had the highest mechanical aptitude test score in a class of 110 students majoring in Industrial Engineering at Purdue University (class of 1939). In a Motor Maintenance Battalion of 650 men and officers in WWII, I had the highest army test score. So I became a "90-day wonder" and was discharged with a superior officer rating. In every engineering office where I have worked, the jobs requiring the most synthesis generally wound up on my drawing table. On the four occasions when I could not work because of chemical contamination, I have either worked on the problems that affect humanity or I have spent time on inventions. I have found that the solutions to the problems of the economy and the environment can be found by the same rigid attention to facts and established principles which yield solutions to problems of machine design

In my 66 years I have seen more history made than any generation has seen before. Now it appears that I will see one more thing—the end of civilization as we know it during this interglacial period. For 10 years I have known that the soils of the world, were running out of minerals and that glaciation was inevitable. For 10 years warnings and the solution have been ignored by people in government.

I don't think I care to see the tragedy which is scheduled to unfold in this decade."

In *The Survival of Civilization*, John Hamaker tells us that "failure to remineralize the soil will not just cause a continued mental and physical degeneration of humanity but will quickly bring famine, death and glaciation in that order."

Glaciation is one way of remineralizing the soil. Large amounts of plant life's carbon moves (as carbon

dioxide) into the atmosphere, as the plant life dies out. We then see what is now happening: the carbon dioxide's greenhouse heating effect is causing large amounts of evaporation from the tropical oceans. Hamaker describes the resulting process as follows: Cold polar air moving over the cold land areas displaces this lighter, warm, wet air from the tropics, forcing the warm air to flow over the warm oceans toward the northern latitudes to replace the cold air, be cooled, lose its moisture to snow and descend over the land mass. The massive cloud cover will result in "huge amounts of cold air being generated, from which ever-increasing amounts of precipitation occur. Every winter must be worse than the last. At some point winters may carry over into summers and destroy crops with frosts and freezes. Numerous temperatures from 32 to 40°F were recorded in the summer of 1978 from Michigan to the Rockies. Cold waves can cause major crop losses in Canadian or Eurasian grain crops, which are mostly at the latitude of Michigan or farther north."

Chemical agriculture uses soluble chemicals that are either acidic or basic, but which have the final effect of acidifying the soil, destroying the soil life, using up the organic matter and, in the end, leaving the soil useless. Because choice soils have been almost fully demineralized in the 10,000-11,000 years since the last glaciation, the popularity of chemical agriculture has grown. However, chemicals, unlike microorganisms, will dissolve the carbonates and a few other rocks completely, liberating some of the remaining useful elements, so that enough microorganisms grow to support a crop growth, but the crop gets a short supply of an unbalanced protoplasm. The crop is then more prone to disease. Bits of useless demineralized skin (cell membrane) weathered from the stone are ignored by the microorganisms as they build the granular, capillary soil system that provides aeration and water retention to the soil. Percolating water carries the bits of subsoil down into cracks under large particles of unused stone. The cracks are caused by drying of the soil. The percolating water washes used material off the top of the unused stone, leaving a space into which the stone can rise when wetting of the soil forces the unused stone upward by the amount of material sifted under it. So, in 10,000 years, 8-10 feet of glacial deposit has been cycled to the topsoil, demineralized by the soil life, and has descended back into the subsoil to form a dense clay. As we said before, there are only 2 1/2 inches of the original deposit left in the topsoil, and *there is no more on the way up*.

We must provide minerals to the soil or glaciation will happen again!

2.8 Chemical Fertilizers and Pesticides

In *The Survival of Civilization*, John Hamaker has the following things to say about chemical fertilizers:

Plant and animal digestive systems will readily pass water into the plant or animal. If toxic compounds are in solution in the water, they too pass readily into the plant or animal. Water-soluble chemicals used in the soil (and in foods and beverages) are dangerous. Any toxic substance can enter a plant or animal with the protoplasm if it has been taken in by the microorganisms. So, anything other than the natural balance of elements and the natural organic compounds produced from them by the microorganisms is damaging to the entire chain of life. The continued buildup in the biosphere of nonbiodegradable synthetic organic compounds is destroying humanity by alteration of the genetic compounds.

As we said before, chemical farming depletes the organic matter in soil. Chemical fertilizer may release enough elements to grow sufficient microorganisms to feed a weak crop, but when the chemicals are used up (on weak soil this often happens before the crop matures if chemicals are inadequate or too fast in dissolving), the production of microorganisms virtually stops. Then too, the stalk is often taken with the grain (or vegetable, etc.), limiting the utilization of the few available minerals in the decreasing supply of passivated stone particles still in the soil. A look at mineralized organic gardens shows that organic farming methods are, by far, more beneficial.

"Farmers who returned corn crop stalks to the soil have the highest yields, maintaining a better reservoir of carbon and nitrogen in the soil to supply the crop. Unfortunately, the acid in NPK is constantly dissolving organic matter and inorganic material from the soil. With an estimated 30 to 50 percent of the acidic component of NPK winding up in the rivers, it is obvious that a lot of the fertility elements are going the same way."

"In the 50s and 60s, the agricultural 'experts' were helping the fertilizer industry by recommending to the farmer that dumping the barnyard waste into a pond was more 'economical' than spreading it back on the land, because the same amount of fertility elements could be 'obtained more economically from NPK fertilizer.' They learned the hard way that crops won't grow without organic matter, so now they say the organic matter is required to 'buffer' the soil. Technically, a buffering agent is one that tends to neutralize an acid or a base. Crop residue won't do that, but if it is put into the soil and there are any minerals at all present, microorganisms will multiply. Obviously, the basic elements in the protoplasm are the most available elements in the soil for buffering the acidity in NPK. If the rains are gentle, the dissolved protoplasm may be reconstituted into new organisms before it is leached or eroded into the river. And that can take place only if there are enough basic elements in the soil so the microorganisms can find what it takes to bring order out of chaos. The natural mixture of elements is geared to natural conditions—not to the absurd practice of deliberately acidifying the soil. Basic elements would have to be added to the natural mix to compensate for the manmade acid."

"Nitrogen is the most acidic component. If I can get 60 bushels per acre of wheat *without* nitrogen fertilizer, why should farmers buy it from the chemical companies?"

"Phosphorus should be left where found, because those deposits contain large amounts of fluorides. The agricultural soils are now badly contaminated with fluorides. Fluoride levels in food are increasing. Cattle concentrate the fluorine in their bones. When the bone meal is used in pet foods, fluorosis results. Do we wait until the overt symptoms of fluorosis show up in half the population before we stop this nonsense?"

"There is plenty of phosphorus and potassium in the natural rock mixture* and at a much lower price. If a farmer uses 200 pounds of a 15-15-15 NPK fertilizer, he gets about 100 pounds of gravel dust* per acre. (*Rock mixture and gravel dust will be discussed again in the next lesson. River gravel screenings—to add to the soil to remineralize it—can be purchased for under \$6 a ton!) The gravel dust in the NPK fertilizer costs about 75 cents, but the fertilizer is priced at \$25 to \$30. (Editor's note: these were prices at the time the book was written, several years ago). What the farmer pays for is five paper sacks and me chemicals, neither of which he needs, and sooner or later the chemicals will destroy the land—some 'bargain'!"

"The USDA's Conservation Service has finally come to the conclusion that we are not going to continue the habit of eating much longer. They base their conclusion on the following: we had 18 inches of topsoil a couple hundred years ago; now we have only several inches of topsoil. The U.S. is losing 6.4 billion tons to erosion every year. All of the soils are eroding, and 1/4 of them are eroding at a destructive rate."

"How widespread is the practice of using gravel dust as the filler in a sack of NPK, I do not know. In those areas where gravel screenings or sand has been the most economical filler available, the dust has probably been used for years. I suspect that it is now a general practice because all soils have been largely stripped of some elements, and there is no cheaper way to add them."

"Generally speaking, the fertilizers, as exemplified by 'Eco-Agriculture,' use a mixture of minerals in combination with a compost or compost-like material which is high in nitrogen and carbon."

"Organic farming, as advocated by the Rodale organization, concentrates on organic matter plus specific fertilizers such as greensand and granite dust."

The chemical NPK will accelerate erosion. Eco-Ag and organic methods will slow the rate of erosion and maintain better balance of elements in the soil. None of them are supplied in amounts sufficient to build-up the mineral supply in the soil. All of them are partially dependent on the dwindling availability of the small amount of gravel and sand remaining in the soils. They work best on the strongest soils."

"All three fertilizing methods are dependent on annual applications. If anything were to interrupt the production and distribution for one crop year, we would starve to death in large numbers."

"None of these will sustain our food supply indefinitely. They will also not do the all-important job of removing excess CO₂ from the atmosphere. They are all too expensive. We must have a *bulk production* and *distribution* of gravel dust, or its equivalent. Without it there is no future for civilization."

" 'Hazardous Substances and Sterile Men' is the title of a powerful condemnation of the chemicals industry in the September 1981 *Acres U.S.A.* Ida Honorof has summarized research on this subject. In 1981, 10-23% of American males were sterile (very unlikely to father a child). In 1938 only 1/2 of 1% of males were sterile. According to this research, in 30 years, half of the males will be sterile, and 67-83% of all birth defects are caused by men—the chances of causing a deformed child to be born increase with the quantity of chemicals in the sperm. Ten chlorinated chemicals alone have been found in the sperm. Birth defect rates in the United States are believed to be about 6%—it seems only a few years since that estimate was 3%. Many of the chemicals contaminate our food supply. One statistic says that 94% of food has pesticides in it.

"If people keep eating the poisoned foods of chemical agriculture, there will be more cancers, deformities, stillbirths, and as many different ailments as there are parts in the body. Either we stop the manufacture of organic chemicals which are not readily biodegradable or we destroy ourselves."

"*The balance of nature*, in part, means that for every living organism there is a predator, so that no organism can populate the earth to the exclusion of all others. Our asinine, conceited view of ourselves as 'masters' of nature has led us to make a wreck of the balance of nature. We are paying a high price and we will continue to pay for a long time, even if we turn quickly to a rational concept of our role in the natural order. I have seen radical improvements in the ecology on two small plots of land when the poisoning was stopped and minerals applied to the land. Perhaps nature can rather quickly reestablish the animated part of the balance of nature."

John Hamaker

3. Questions & Answers

What can we do to lessen starvation and hunger in the world?

If you want to lessen hunger in the world, look around you. Many cities have some types of food distribution programs and/or "soup kitchens" (places where people can go for a meal). You can support these programs, or if your area does not have them, perhaps you can become involved in getting them started. If you prefer even more *direct* action, you can "adopt" (figuratively speaking) an elderly person or persons, and/or a family. In every community there are people who need help—just look or ask around, and you will find them

If you go on vacation in another country, you may want to meet some of the residents of its small villages, and spend some of your money into their local economies instead of just spending it all at a modern hotel in a big city. Your life will be enriched by the experience, to say nothing of learning a whole lot more about life and other cultures than you would back at the hotel! When you return home to the U.S., you will know someone *real* that you can send a "care package" to now and then (clothes or household items, etc.). This is easy to do, and a needy family in an impoverished area will really appreciate your thoughtfulness. When you send a package directly to someone you know abroad, you'll know exactly what they need and "who is getting what"—when funds are sent to "traditional" charitable organizations, they keep something for their operating expenses, and you may not be as sure about how much finally reaches anyone, or *how* the money is actually being used. (I once saw a group asking for more money "to provide medicine for children". They'd be better off with fruit or other fresh food, and clothing!) I went with friends to a tiny village on the Mexican seacoast once, and every few days we brought boxes of fruit and vegetables for the family we stayed with; each time, the next day there'd scarcely be a banana left over—the children *loved* fruit. Unfortunately, if we'd just handed money to their father, he'd have probably gotten a few bottles of liquor since he liked to drink—we just brought food and other things like laundry soap, batteries, candles—things the family used daily. (We did give Mom some money now and then; she used it for the family.) The day we left, we tucked a 1,000-peso bill into her hand. At the exchange rate then, this only amounted to about 10 dollars for us (an easy gesture), but for a woman who didn't work outside the home (there were *no* paying jobs for women in their village), this was like a *windfall* (it would also go further there than its equivalent \$10 would go here in the United States)

Along with many beautiful memories, this was the gift these people gave to me: the chance to be on the giving end for a change, to feel as if I could actually make some difference in someone else's life—as much a gift to me as anything I could have ever given them. For we are truly *fortunate* when we are *able* to give, and this also means giving of ourselves as well as of our possessions. When we reach out to other members of our human family abroad, we draw our world family closer, we strengthen the bonds. We exchange a *mutual* gift, that of increased understanding, and of a vision of a world in greater harmony. We are indeed brothers and sisters—our mirrored smiles tell us this, even when we "don't speak the same language", At last we become *real* to each other

Another note on the joy of being able to give to people *wherever* we may be: someone once told me that members of the so-called "beggar caste" of India also had their "special life purpose", their purpose being to *allow others to be givers* (the givers thus being given a chance to enhance their own spirituality by an act of giving). This concept returns the dignity owed these "beggars" as human beings; it sees beauty in every person

Come to think of it, I remember the strategy used by some elderly women in the marketplace of Casablanca, Morocco, one that was quite ingenious. When the vendor gave you your change and you reached out for it, you'd suddenly be aware of another hand stretched out alongside your own, making it a bit *awkward* to "pretend you didn't have any money" (to say the least), but at least you were guaranteed an immediate increase in your level of spirituality!

When you are at home, remember too, as we said, that hunger may be as close as a mile from your house

Pressure your local leaders to take *real* action against hunger. Sometimes "surplus" food is just held in storage, or even *dumped*—I once saw a news item on TV showing perfectly good oranges being dumped to "keep prices normal" (they didn't want too many oranges to "flood" the market!). It is immoral to keep this food from hungry people

Another way to alleviate hunger around you may be as close as a few friends who live on a tight budget—invite them over more often for meals. Share the harvest

If you can't find someone who is hungry, you aren't really looking. Remember, most people are *much too proud* to ask or tell you, so you need to be aware and sensitive to others' needs

Years ago I was staying in the Canary Islands off the coast of Africa, in a small boarding house, and a young woman lived in the room next door with her three children. Every day she went to work and, although the landlady (who lived downstairs) looked in on them now and then, the little four-year-old girl was really in charge of her younger brother and sister. Once I saw her peel potatoes, light the gas burner on the stove, and fry them, and I must admit, it was the first time I'd ever seen a four-year-old cooking completely on her own. One day I went in to offer her an apple and she said no. Three times I offered it, to no avail. When I went back to my room and mentioned this to my roommate, she said, "just go in there and set it on her table". I was skeptical, having assumed the child just didn't want the apple, but I did so anyway. A minute later she'd finished eating it

The "moral" of this story is, not only will some people not ask for anything, but they may even refuse something you offer, because they "don't want to be a burden to you". When you ask "do you want this?" or "do you need this?", they're very likely just to say no, out of pride, whether they do or not. So, keep your eyes open and assess the situation. The idea is not to make someone feel like they are accepting "charity"—no one really wants to be in this position. There's always a way around these delicate situations. Let the person know that you "have extra and can't possibly eat it all yourself," i.e., they're doing you a favor by taking it off your hands. There's a subtle difference

The following was excerpted from *Mother Jones* magazine (September/October 1981), by Loretta Schwartz-Nobel:

"I found her by accident, trying to crawl out of her doorway and down the broken concrete steps in an effort to get food. She was 84 and living alone in an abandoned house in Philadelphia. That afternoon in 1974 I went with my seven-year-old daughter Rebekah to our local supermarket and bought food for Mrs. Roca. In the months that followed it became a habit to take several bags of groceries to her each Saturday afternoon. Rebekah thought of it as the best part of our week. Another woman, Julia, also in her 80s,

lived nearby. Once she had tried to go to a local supermarket, but tripped and fell in the gutter, and lay there until a little boy stopped and helped her. The next time she tried, someone grabbed the bag of groceries on her way home and ran off."

I saw a TV documentary one night on the elderly in Chicago—some of them were being shuttled to and from the store in a bus because they were such easy targets for muggers. These people helped to build our country, and this is their "retirement dream"—these are their "golden years"—having to go to the store in a group because it is dangerous to attempt it alone

A young boy interviewed on TV discussed his way of helping others—one night he saw a documentary on "street people" of his city, and asked his parents to take him to see them. They were a bit hesitant, but did so. Now he checks on the street people daily, bringing food, clothes, and so on. (In fact, other people began leaving boxes of things at his house, too, for distribution.) This boy sees these people as *people*, not "street people," and his father said that, while an adult keeps a distance, his son would touch these people or hug them—he now knows all the "regulars" there by name. A man on the street wrote a letter that was read on the show, and he sums it all up better than I ever could:

"One day I was so tired of living that I decided to *end* it all. Then something happened—that day I looked up into the eyes of a young boy, who smiled at me and handed me a blanket. That day, not only did I fall in love with this child, but I fell in love with *life* again, because my faith in humanity was restored."

Unless we've known true hunger and need, it's difficult to understand what it's *really* like to "live on the edge," but we can be sure of one thing: every morsel of food we give to anyone, in nourishing a fellow being, *adds to life*, and what can we do on this earth that is of greater purpose and joy, than to add to life? Let's recall, in our humility, that each morsel of food given to *us* by life and the powers that be is a miracle—we are all *receivers* as well as givers—we should never take this miracle for granted.

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Article #1: How Vitamin and Mineral Content in Food Decreases Step-by-Step

In this lesson we have seen that there is more than one way in which food loses vitamins and minerals, but that most of our food is subjected not only to *one* but to a *combination* of assaults on its nutritional value, as indicated below:

- Food is grown on mineral-depleted soils in the first place.
- Plant breeding of hybrid seeds, and crop management, result in another measurable decline in protein and vitamin/mineral content.
- Pesticide spraying leaves poison residues in our food.
- Food processed by any of the techniques mentioned in the lesson (irradiation included) further decreases its value. (Note: It wasn't specified whether fresh food could also be irradiated *before*

being shipped to food processors; only irradiation of food destined for the produce stand in our stores was discussed. However, it is conceivable that some food could be irradiated to keep it "fresh" longer for the food *processors* as well, in which case it would undergo two assaults in this step alone.)

- As if all the above steps do not reduce the life in our foods enough, much of our food is then cooked, spiced with condiments, salt, etc., smothered in sauces, and, to top it off, eaten in excess and/or in improper combinations, washed down with beverages that dilute our stomach's digestive enzymes, and often eaten in a hurry, and/or according to "the time of the day" instead of true hunger, and sometimes in a state of mind that is not conducive to good digestion.

We are paying dearly for our ignorance, indifference and lack of good conscience, because we are destroying more and more of the *life factor* within our foods each time we alter them further from their natural, fresh state.

How can we expect food that is virtually *dead* to sustain life? It has been said, with reference to vegetarianism vs. meat eating, but this also applies in the case of lifeless, foodless foods, that: "from life comes life, and from death comes death."

The choice is ours.

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Article #2: Saving Open-Pollinated Seeds by Margaret Flynn

One of the first things to remember when saving seeds is *never plant all your seed from one stock*. Always save some in case anything should happen to your crop.

You need to be aware that cross-pollination of seeds can occur from other vegetables in the same family, or from other gardens within about 1/4 mile.

It's best not to save seed from just our largest tomato, for example, but to save seed from the smallest, largest, earliest and latest fruits. Equal amounts of these four types of seeds should be mixed. In this way we will have a much greater genetic diversity in our seed samples. We should look at the whole plant too, not just the fruit. Select several plants to save seed from, those with characteristics you want for your next year's plants: size, flavor, earliness, ability to survive a short season (where applicable), disease-resistance, drought-resistance, insect-resistance, lateness to bolt, trueness to type, color, shape, thickness of flesh, hardness and storability. All these factors can and should be selected for.

Temperature and moisture extremes, especially in combination, can cause damage to seeds before harvest. For example: an early sustained freeze while the seeds still have a high moisture content. It is best to have dry weather before and during harvest, so that the seeds can dry on the plant and remain dry.

Drying Seeds

When drying and storing your seed, you want its vigor to stay as high as possible so that seeds will germinate rapidly with good disease-resistance. Vigor is destroyed by high temperature and high moisture during storage. Seeds can be dried on a screen or on wax paper in the sun, by sealing them in an airtight container with silica gel (until they reach the proper moisture levels for entry into storage), or by putting them in your oven with the pilot light on and the door cracked.

(WARNING: Damage to seeds will begin at temperatures of 96° F or more. Even at the very lowest

setting, an oven temperature can vary enough to damage your seeds.)

Seeds *must* be completely dry before you store them and they should break instead of bending (less than 8% moisture). Store seeds in a completely airtight container at as low and constant a temperature as possible. Put each variety of seed in an envelope and write the name and year on each one. Put these envelopes into any glass jar that has a rubber gasket lid that can be screwed down tight enough to make the container airtight and moisture-proof. Homemade gaskets can be cut from old inner tubes.

Adjustable channel-lock pliers can be used to screw the lids on as tight as possible. Black electrical tape can be used to seal questionable lids.

Another possible container is a flat bag that has laminated walls of paper/foil/plastic. It can be sealed with a Seal-A-Meal, or sealed with an iron set on "wool" applied to the open end of the bag for three seconds. (The sealed edge can later be cut off and the bags reused.) They can be put directly into the freezer and take up less space than jars; they are also inexpensive.

Your containers can be kept in a freezer with no damage to the dry seeds. The next best place is a refrigerator, and the next is any cool area where the temperature will remain as constant as possible. When you take the container out of the freezer, you must let it sit out overnight to come to room temperature *before* you open it. If you don't, moisture will condense on the cold seeds and your effort to dry them will have been wasted. Do not leave the container open for any length of time, and don't go into it too often because temperature fluctuation is not good for the seeds. If you store your seeds by this method, they will hold their vigor for up to five times the period shown on viability charts.

We discussed reasons for saving nonhybrid, open-pollinated seeds, what to consider when choosing plants for saving seeds, and how to dry them. Let's look at some more detailed information on specific vegetables.

Beans

Phaseolus vulgaris contains common bush or pole beans, whether used for green snaps, green shell or dry. They are self-pollinating before the flower opens, so there is very seldom crossing. Sometimes you'll notice variation or oddities in the seed that may be due to a genetically unstable variety or a difference in conditions such as a change of soil pH or wetness at harvest rather than to any true crosses. You can plant varieties of *Phaseolus vulgaris* side by side.

Phaseolus coccineus are "runner beans." You can tell these when they come up because they develop with their two seed halves *under* the ground. Their flowers are self-pollinating, but bees or bumble bees and hummingbirds work them heavily and thus cross them. You should either grow only one variety of runner beans or separate two of them by at least the length of your garden.

Mark a few of your best plants, and let the pods dry out completely on the plant, weather permitting. When most of the leaves have fallen off, pull the plants and hang them under cover to finish drying. Small amounts of seed can be shelled by hand; for large quantities, make sure beans are thoroughly dry, crush or thresh pods, separate the beans from the chaff by winnowing in the wind; label, and store.

Weevil eggs are almost always present under the bean's seedcoat and can ruin your seed in a few months. They can be killed by placing the thoroughly dry beans in a tightly-sealed jar and freezing them for at least a day.

Broccoli

Broccoli produces seed its first season (unlike the other biennial members of the cabbage family) if you sow it early enough that plants are quite large by the long days of summer. However, it crosses readily with cabbage, kale, brussel sprouts, cauliflower, or kohlrabi, if any of these are flowering within 1/4 mile. Don't cut flower heads for food that you are saving seed from.

Chinese Cabbage

Brassica pekinensis is a cross-pollinating annual. It will not cross with any of the cabbage family, but will cross easily with other varieties of Chinese cabbage. It sends up a seed stalk which forms a pod that will turn brown when mature. If you plant more than one variety of Chinese cabbage, the isolation distance is 1/4 mile. The rest of the method is the same as with lettuce.

Corn

Corn is wind-pollinated, so any corn (sweet, popcorn, ornamental, dent, flint, etc.) will cross very easily with other corn. To keep corn "pure," you must grow it 1/4 mile from any other corn, or hand-pollinate it. Corn is very "plastic," so by observing and selecting carefully you can gradually determine characteristics your future crops will have. Let ears you are saving seed from ripen on the stalk until husks are dry, pick them, pull husks back, tie several husks together by the husks, hang in a dry, well-ventilated place until completely dry, shell, save only completely-formed kernels, and store. (An early and late variety can be planted side by side if the early one stops pollinating before the silks of the late one begin to emerge.)

Cucumbers And Cantaloupes (Muskmelons) And Watermelons

These all belong to different species and will not cross with each other (bug gherkins cross with cukes, muskmelon with casaba, and watermelon with citron). They are all insect-pollinated, so different varieties of each of the three *will* cross easily among themselves. If you are going to save seed, grow one variety of each. (Remember that with vine crops and any other vegetable that crosses very easily, that if you have any neighbors within 1/4 mile who are also growing that vegetable, you would be wise to try to supply them with your seed.)

Let a few of the earliest maturing well-formed fruit become completely ripe (cukes turn golden yellow, muskmelons crack at the stem, watermelons have a deep hollow sound when thumped). This ruins cukes for eating, but with watermelon and cantaloupe, the seeds are mature when they are ready to eat. Scoop out the seeds, wash them gently to remove pulp (a sieve may be used), and let them dry totally on a piece of foil. Keep them separated and stir them occasionally so they don't stick together. When completely dry, label and store. (Remember, seeds are dry when they break instead of bending.)

Eggplant

Pollination is like peppers, so separate varieties by the length of your garden or with a tall crop. Leave the best fruits on several of your plants for as long as possible, and when fully mature, scrape out seeds, separate from the pulp, dry and store.

Gourds

Legenaria siceraria are hard-shelled bottle gourds with evening-blooming white flowers. They don't cross with vegetables in the squash section, edible varieties include: Cucuzzi (also called Italian Edible Gourd and Italian Climbing Gourd) and Guinea Bean Gourd (also called New Guinea Bean and New Guinea Buttervine). Saving seeds of squash, pumpkins and gourds is the same as with cucumbers (except that summer squash varieties must be left on the vine much later than the eating stage, until the shell is quite hard).

Lettuce

Lettuce is self-pollinating with little chance of crossing. Select several of the firmest heads or best leafy plants which are slowest to bolt (send up their seed stalks). When seed is fully developed, pull plants and hang them under cover to finish drying. Crush pods, separate seeds, label and store.

Okra

Okra is self-pollinating, so you can grow more than one variety with little separation. Leave at least two of your best plants completely alone. When pods are dry, but before they open enough to drop seeds on the ground, shell them and save.

Peas

Peas are self-pollinating, but cross slightly more easily than beans. So if you grow two varieties, separate them by the length of your garden or with a tall crop. Everything else is the same as with beans.

Peppers

Peppers are mainly self-pollinating, but insects may cause some crossing in varieties planted closer than 1/8 mile. When growing more than one variety of peppers (or if sweet *and* hot), separate them by the length of your garden or with a tall crop to keep them from crossing (and sweet peppers from becoming hot). Select several of your largest and best peppers from your best plants. Let them ripen on the plant until red and starting to soften, scrape out seeds, dry and save.

Potato

Potato varieties don't cross since tuber divisions are really just clones. Crossing between potato flowers affects seed balls, not the roots. Select a few of your best-looking plants that are surrounded by healthy plants to save for seed. Never keep potatoes for seed that show any sign of scab. You might be able to increase your production by planting small (egg-sized) whole potatoes, since they are less apt to be badly sprouted and often produce a vigorous plant more quickly than cut potatoes. If planting small whole sprouted potatoes in spring, don't damage the big sprout on the eye end of the potato since this will produce the most vigorous plant. You can just break most of the other sprouts off. Some people think that yields are improved by planting sprouted potatoes. Plants sometimes emerge in just a few days (sometimes two weeks) ahead of nonsprouted potatoes. Dig potatoes when the vines *begin* to dry up—when the soil loses its shade, it gets hot and your crop may be damaged. Washing/not washing doesn't seem to affect how well your potatoes keep. After drying in the shade for only a few hours to toughen their skins, they are ready to store, the colder the storage temperature the better (34°-40°F). It's been said that burying them in dry sand is the perfect way to store them.

Pumpkins And Squash

These are insect-pollinated and cross very easily. All pumpkins and squash belong to one of four species of the genus *Cucurbita*, so when saving seeds, plant only one variety of each of the following species:

Curcubita Pepo includes summer squash, all true pumpkins, varieties that are both bush and long-vined; stem and branches both have five sides and spines. Includes all *acorn* squash (Des Moines, Ebony, Ebony Bush, Jersey Golden, Royal, Table King, Table King Bush, Table Queen, Table Queen Bush, Table Queen Ebony, Table Queen Mammoth), Black Beauty, Casserta, Cheyenne, Chiefinei, Cinderella. Includes all of the *cocozelles* (Green, Vining), Connecticut Field, Cozini. Includes all of the *crooknecks* (Dwarf Summer, Early Summer Golden, Early Summer Yellow, Golden, White Summer), Crystal Bell, Delicata. Early Cheyenne Pie, Fordhook, Fordhook Bush, Fort Berthold, Golden Centennial, Golden

Custard, Golden Oblong, Hyuga Black, Jack O'Lantern, Kikuza White, Lady Godiva, Little Boo, Lunghissimo Bianco Di Palermo, Mammoth Gold. Includes all the *marrows* (Boston, English Vegetable, Green Bush Improved, Long White, Vegetable, White Bush, White Vining Vegetable), Naked Seeded, New England Pie Pumpkin, Omaha, Panama, Perfect Gem, Pie Pumpkin, Royal Bush. Includes all the *scallops* (Benning's Green Tint, Early White Bush, Early Yellow Bush, Long Is. White Bush, Mammoth White Bush, Patty Pan, St. Pat, Summer Bush, Yellow Golden), Small Sugar Pumpkin, Spaghetti Squash, Spookie, Stickler, Straightneck, Early Prolific, Streaker, Sugar Pie, Sweet Dumpling (Vegetable Gourd), Table Gold, Thomas Halloween, Tricky Jack, Triple Treat, Uconn, Winter Luxury, Winter Nut, Youngs Beauty, Vegetable Spaghetti. Includes all *zucchini*s (Black, Burpee's Fordhook, Burpee's Golden, Dark Green, Gold Rush, Gray), and any of the small Hard-shelled, Striped and Warted Gourds.

Cucurbita maxima have very long vines and huge leaves, stem is soft, round and hairy. Alligator, Arikara, Atlas, All banana squash (Blue, Giant, Orange, Pink, Pink Jumbo), Bay State, Big Max, Big Moon. All *buttercups*: Blue, Bush. All *delicious*: (Golden, Green), Emerald, Essex, Estampes, Gilmore, Gold Nugget, Greengold, Guatemala Blue, Hokkaido Green, Hokkaido Orange. All *hubbards* (Baby, Baby Blue, Chicago, Chicago Warted, Warted Green, Warted Improved), Hungarian Mammoth, Hungarian Mammoth (Cornell Strain), Ironclad, Kindred, King of Giants, King of Mammoths, Kuri Blue, Kuri Red, Mammoth Chili, Mammoth King, Mammoth Whale, Mammoth (Genuine), Marblehead. All *marrows*: (Autumnal, Boston, Orange, Prolific), Plymouth Rock, Rainbow, Red Estampes, Show King, Sibley, Silver Bell, Sweetmeat, Tuckernuck. All turbans (American, Golden, Turks), Victor Watten, Winnebago, Yakima Marblehead.

Cucurbita Moschata has large leaves and spreading vines, and a smooth five-sided stem which flares out as it joins the fruit. African Bell, Zizu Gokwuase, Alagold, Butter-bush. All *butternuts* (Baby, Early, Eastern, Hercules, Ponca, Puritan, Waltham, Western), Calabaza (Cuban Squash), Calhoun, Cangold. All *cheese* (Large, Long Island), Fortuna, Futtsu Kurokawa, Golden Cushaw, Hercules, Kentucky Field, Melon Squash (Tahitian), Patriot, Peraora, Ponca, Tahitian (Melon Squash), Virginia Mammoth, Wisconsin Canner.

Cucurbita mixta was formerly included with *C. moschata* and has similar characteristics. Chirimen, the *Cushaws* (except Golden Cushaw which is *C. moschata*), (Green Striped, Solid Green and White), Japanese Pie, Mixta Gold, Tennessee Sweet Potato.

Varieties *within* a species (one of the four groups) cross very easily, but don't worry about crossing between species. Crosses between different species are hard to make and their progeny are so highly sterile, that crosses by natural means are unlikely to cause concern. You do need to consider pollen from neighbors' gardens contaminating your efforts at keeping pure seed strains, if they are within 1/4 mile. Otherwise you can use these lists to keep four varieties of, pumpkins/squashes pure (one from each species). If your aim is purity (and/or if you are sending seeds to the Seed Savers Exchange) and you do have close neighbors, you need to hand-pollinate. Otherwise you could lose in one season what someone else has spent a lifetime of gardening to develop or preserve. (If you are afraid that a squash you are growing might have crossed, remember you won't see the variation in that summer's fruit. Grow it again to check it. If it has crossed, you'll see the variation when you grow the seed from the fruit that crossed.)

In an experiment to determine at what point there was the greatest number of fertile squash seeds, they found it to be 20 days after the fruit is fully mature—a 20-day after-ripening period when the seed actually improves in the fruit after you pick it.

Radishes

Radishes are insect-pollinated, so grow only one variety. Choose several of the largest, earliest roots to save seed from. The seed pod on the seed stalk will turn brown at maturity. At that point, pull the plants and finish drying under cover.

Spinach

Spinach cross-pollinates and has very fine pollen that is carried long distances by the wind. It only crosses with other varieties of spinach, very easily. Plant one variety only for purity in seed strains. Save seed as with lettuce.

Sunflowers

Sunflowers cross easily with wild sunflowers, making them unsuitable to save for seed. Some people call this home-saved seed that is "running out"—seed doesn't really run out, but if you don't take the right precautions, a gradual process of undesirable crossing over several generations can make the seed of some vegetable varieties practically worthless.

Tomatoes

Tomatoes are over 98% self-pollinating, but even such a slight amount of insect pollination over a number of seasons may be enough to destroy the characteristics that made the variety unique. Don't grow tomato varieties side by side if you want to save seed from them. Remember, don't just save seed from your largest tomato. For better genetic diversity, save seed from the smallest, largest, earliest and latest fruits. (This would only be twice the work if you saved seed from the earliest and also a large fruit at the beginning of the season, and the latest and also a small fruit near the end of the season). Mix equal amounts of these four seeds.

Select well-formed fruits from a few of your best plants and let them ripen on the plant beyond the edible stage until they are getting soft, but not to the point where they are going bad. Squeeze seed from several fruits into a glass, add some water, let the mixture ferment at room temperature for several days, stirring vigorously several times daily. After a couple of days the good seed will be on the bottom and bad seed and pulp will float on the top and can be washed away. This fermentation is said to kill several seed-borne diseases (many people use this method to separate seeds from pulp whenever seeds are embedded in soft fruit). If you don't want to use this process, squirt the seeds into a sieve and rub them with your fingers against the sieve under running water. Pick out or work all the pulp through the sieve and keep working seeds until the whole batch is really clean. Then spread them thinly and separately on wax paper. When they are completely dry, label and store.

All of the above vegetables are annuals, which grow and develop seed in one season. Biennials don't produce seed until the end of their second growing season. Biennials are: the root vegetables (carrots, onions, leeks, parsnips, rutabagas, salsify, beets, turnips, celeriac and winter storage-type radishes), the cabbage family (cabbage, broccoli, brussel sprouts, cauliflower, and kohlrabi), parsley, celery, kale (or borecole), collards, endive and Swiss chard. All these vegetables (except salsify and endive) are cross-pollinated, so to save seed and keep it pure, grow only one variety of each and only one member of the cabbage family, since they all cross. Select good-sized roots or firm heads to save seed from, dig them before frost, keep them in cool storage over the winter, replant them the following spring and they will bear seed that summer. If your climate isn't really severe (or with hardy roots like turnips and rutabagas) you may be able to just mulch them heavily over the winter, take the mulch off early in the spring and let them go to seed. Carrots will cross with wild carrots (Queen Ann's lace) if your garden is surrounded by meadow. Swiss chard, beets, mangels and sugar beets all cross. Celery and celeriac cross. Turnips and beets and broccoli will behave as either an annual or biennial depending on the climate they are grown in.

Hot Water Treatment of Seeds

This is a method for controlling the seed-born phase of diseases such as black rot and black leg in the cabbage family, bacterial canker and target spot in tomatoes, and Septoria spot in celery. You'll need an

accurate thermometer, electric fry pan, large sauce pan, kitchen sieve and paper towels. Try a practice run without the seeds. Heat some water to 50°C. Pour a little into the warm electric fry pan, fill the sauce pan 2/3 full and set it in the fry pan. Regulate the temperature either by late the temperature either by turning up the fry pan or taking the sauce pan out of the fry pan. When you can maintain 50°C, pour in the seeds, stir until they are all wetted and not floating, then stir gently throughout the whole process. Treat broccoli and Brussel sprout seed for 20 minutes at 50°C, cabbage for 30 minutes at 52°C, cauliflower for 25 minutes at 52°C, celery and pepper seeds for 30 minutes at 50° C, and tomato for 25 minutes at 55°C. Then sieve the seed and spread it on paper towels away from direct sunlight, dry and store them.

Germination Testing

If you want to test the viability of your seeds, especially if you intend to exchange them with the Seed Savers Exchange (in fairness to fellow members), you can take 10, 25, 50 or 100 seeds for each variety, roll in a damp paper towel, put in a plastic bag, and put it in a warm spot. Count the sprouts after 7-10 days. Seven sprouts per 10 seeds is 70% germination, etc. The idea is to be sure that at least *some* of your seed will sprout; it's better to find out you have more to learn about saving seed than to have you or an exchange member waiting next spring for your seed to come up.

Cleaning Seed

Seeds that are harvested wet can be cleaned by floating off the light (and weak) seeds, hollow hulls and other debris. This works well for tomatoes (after fermentation), peppers, eggplant, melons and squash. Remove seeds from fruit, ferment if required, add water and stir vigorously. Good seeds are heaviest and sink; the rest of the debris floats and can be poured off. Repeat this four or five times or until the water poured off is free of debris. Rub wet seed over a sieve to remove attached pulp, rinse again, and dry.

Seeds that are harvested dry should be rubbed and winnowed to remove chaff.

Isolation and Purity

We have used isolation and planting only one variety of cross-pollinating crops to maintain pure strains, but it should be noted that even self-pollinated plants may cross if conditions are just right. If your aim is absolute purity and you are saving seed from more than one variety of a self-pollinating crop, separate varieties by at least a row or two of another crop.

Thanks for saving seeds!

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Article #3: Hand Pollination of Squash By Richard Grazzini

Excerpted from one of the Seed Savers Exchange catalogs.

This year I looked at about 150 different varieties of squash. A few were commercial hybrids or commercially-available standards, but most were heirlooms. On the other hand, some of the heirlooms were obviously crosses of two (or more) winter squashes, or winter squashes and summer squashes. If you grow squash for seed, PLEASE hand pollinate or grow only one variety of each species. You could wreck in one season what someone else has spent a lifetime of gardening to develop or preserve.

To keep varieties of squash from crossing and to make them come "true", you must self pollinate them by hand. First, in the late afternoon or evening, find both male and female flowers that are unopened, but firm and yellow (the female flower has a small "baby" squash below it). These will open overnight unless they are sealed. *Wilted* yellow flowers have already opened—don't use them. The flowers you will be using the next morning must be sealed so that bees don't do your pollinating for you and bees are early risers! I usually seal with 1" or 2" masking tape placed around the top third of the flower. The next morning, wait until the dew dries and then pick the male flower. Remove the petals from both male and female flowers. Swab the pollen-covered part of the male flower on the stigma of the female flower. A glassine envelope should be ready to use (so the open flower is not exposed for too long). Cover the female flower after pollination with the glassine envelope and hold it in place with a wired label which closes the glassine envelope and labels the pollination all in one step. This will let you keep track of your hand-pollinated fruit all during the summer until harvest.

That's it, except for removing the glassine envelope after three to five days. If the envelope is *not* removed, more often than not the fruit will rot. Always make as many hand pollinations as possible. A fruit may rot at any time and you can lose a variety because you quit one flower too soon. Self pollinating a naturally-crossed crop can lead to what's called "inbreeding depression" or a loss in plant vigor. Luckily for those of us who like to work with squash, squash don't seem to show any inbreeding depression. Watermelon and cantaloupe can be hand pollinated just like squash. The flowers are smaller and not as easy to manipulate. You may have to use tweezers, but it works.

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Article #4: The Spirit Speaks

I have never once deviated
In my love for you
From the moment you were conceived
I have loved you with a love
Changeless
Endless
Irrevocable
There has never been a day, an hour, an instant
When I was not with you
Loving you
I nurtured you as a seed
Enfolded you as a child
Strengthened you as man
I was an invisible shield over your head
Though you knew it not
I am still that invisible shield!
With infinite care I attend your wounds,
Govern your heartbeat
Remove the wastes that do not belong
I sleep not at night

When you close your eyes
Yielding at last more fully to my care
I go to work
And heal, as far as I can
The ravages of your insane, inexplicable self-activity
You imagine in your blindness
That you can love or not
As you choose,
Condemn, criticize, hate
As you choose
Fortunately for you I have no such choice
I am true always to the solemn dictate of love
I respect to the last the covenant I made
When I came into the world
Yet I know too that you cannot survive
If you continue to fight against me,
Ignoring my government
Preferring strange impulses of your own choosing
Rejecting me you reject love
This is why you are always looking for love
But never find it
Just when you think you have it
Love
Like a bird
Flies away
Your songs, art, literature, all sing
This vain and fruitless quest
For a love that will never change
A love that will never die
A love that is ever new
Turn to me
Acknowledge me
Accept me
Love me
And you will know such love
Here and now
Together we will restore the world
To order and to beauty.
—Origin unknown

Article #5: Origin of the World's Basic Food Plants

Almost all of the world's basic food plants originated in a few relatively confined areas of the planet, close to the equator, named Vavilov Centers after the renowned Russian plant breeder and geneticist N. I. Vavilov. Although these areas remain the sole source of all natural food plant varieties, they are rapidly being urbanized, and much of the agricultural land is being planted with patented hybrid seeds developed in Europe and the U.S.

Old World Centers

1 ETHIOPIA

Banana (endemic)
Barley
Castor bean
Coffee
Flax
Khat
Okra
Onion
Sesame
Sorghum
Wheat

2 MEDITERRANEAN

Asparagus
Beet
Cabbage
Carob
Chicory
Hops
Lettuce
Oat
Olive
Parsnip
Rhubarb
Wheat

3 ASIA MINOR

Alfalfa
Almond (wild)
Apricot (secondary)
Barley
Beet (secondary)
Cabbage
Cherry
Date palm
Carrot
Fig
Flax
Grape

Lentil
Oat
Onion (secondary)
Pea
Pear
Pistachio
Pomegranate
Rye
Wheat

4 CENTRAL ASIATIC

Almond
Apple (wild)
Apricot
Broad bean
Cantaloupe
Carrot
Chick pea
Cotton (G. herbaceum)
Flax
Grape (V. vinifera)
Hemp
Lentil
Mustard
Onion
Pea
Pear (wild)
Sesame
Spinach
Turnip
Wheat

5 INDO-BURMA

Amaranth
Betel nut
Betel pepper
Chick pea
Cotton (G. arboreum)
Cowpea
Cucumber
Eggplant
Hemp
Jute
Lemon
Mango
Millet
Orange
Pepper (black)
Rice
Sugar cane (wild)
Taro
Yam

6 SIAM, MALAYA, JAVA

Banana
Betel palm
Breadfruit
Coconut
Ginger
Grapefruit
Sugar cane (wild)
Tung
Yam

7 CHINA

Adzuki bean
Apricot
Buckwheat
Chinese cabbage
Cowpea (secondary)
Kaoliang (sorghum)
Millet
Oat (secondary)
Orange (secondary)
Paper mulberry
Peach
Radish
Rhubarb
Soybean
Sugar cane (endemic)
Tea

New World Centers

8 MEXICO-GUATEMALA

Amaranth
Bean (*P. vulgaris*)
Bean (*P. multiflorus*)
Bean (*P. lunatus*)
Bean (*P. acutifolius*)
Corn
Cacao
Cashew
Cotton (*G. hirsutum*)
Guava
Papaya
Pepper (red)
Sapodilla
Sisal
Squash
Sweet potato
Tomato

9 PERU-ECUADOR-BOLIVIA

Bean (*P. vulgaris*)
Bean (*P. lunatus*)

Cacao
Corn (secondary)
Cotton
Edible roots (oca, ullucu, arracacha, ñu)
Guava
Papaya
Pepper (red)
Potato (many species)
Quinine
Quinoa
Squash (C. maxima)
Tomato

10 SOUTHERN CHILE

Potato
Strawberry (Chilean)

11 BRAZIL-PARAGUAY

Brazil nut
Cacao (secondary)
Cashew
Cassava
Mate
Para rubber
Peanut
Pineapple

12 UNITED STATES

Sunflower
Blueberry
Cranberry
Jerusalem
Artichoke

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Article #6: You've Just Been Poisoned By Mike Benton

Have you had a headache recently? Maybe you've felt tired or nervous or irritable for no particular reason. Or has there been some pain somewhere in your body, but you didn't know just where?

Well, consider yourself poisoned—pesticide poisoned, that is.

You may be a victim of pesticide poisoning if you've experienced any of these symptoms lately: fatigue, aching bones, headache, indeterminate body pains, chronic tiredness, mental confusion, fever or other "cold-like" and "flu-like" symptoms.

Many times you may be poisoned by pesticide residues in your food and just not realize it. Pesticide poisoning goes virtually undetected by doctors because they rarely recognize the symptoms for what they are. Since you may not have become immediately sick after eating pesticide-contaminated food,

you may not connect your negative feelings with the poisons you just ate.

While few people do know that many aches, upsets and illnesses are pesticide-related, over 500,000 people each year are *seriously* poisoned by pesticides each year—over one every minute.

Another 5,000 people die each year as a direct result of pesticides. Up to 5 *million* or more cases of pesticide poisonings go unreported or undiagnosed each year.

Everybody in the world—no matter where they live or what they eat—have pesticide residues throughout their body. That's right—you've been poisoned!

Pesticides and Your Health

Pesticides seem especially damaging to the liver and spleen. Blood disorders such as leukemia, anemia and "tired blood" have increased with their use of pesticides. More leukemia cases are reported in the farm states that have had the highest amount of pesticide spraying.

Liver disorders such as hepatitis, jaundice and other ailments have skyrocketed with pesticide use. "It is now believed," says Dr. W. Coda Martin, "that the greater number of hepatitis cases may be caused by DDT on the leaves of green vegetables."

In 1969, Miami University did a study on cancer patients. A random selection of terminal cancer patients revealed that they had exceptionally high pesticide residues in their liver, brains and fatty tissues.

Although we can't blame all our nation's ills on pesticide use, pesticide poisoning is real. Stillbirths, miscarriages- and deformed babies occur most where pesticide use has increased the most rapidly.

Why Is This Happening?

The government is doing a miserable job of keeping pesticides out of our environment. Agribusiness aggressively promotes the use of these poisons for profit—even when they know they are killing people! Does this sound incredible, do you still believe that people are crying "wolf"? Well, read on.

Poisons For Profits

In 1977, workers at a pesticide plant in California discovered that they had been made sterile due to exposure to DBCP (a pesticide). Some of the companies making this poison suspended production while the government investigated. One company, called Amvac, did not.

Amvac told its stockholders that although DBCP had suspected "carcinogenic and mutagenic" properties, they would continue to sell it. They explained: "It was our opinion that a vacuum existed in the marketplace that (we) could temporarily occupy...(and) with the addition of DBCP, sales might be sufficient to reach a profitable level."

Finally, after two years that it was determined DBCP did indeed cause sterility, the Environmental Protection Agency banned its use in this country. So, do you think you're safe? Nope. Read on.

Deadly Bananas

Although DBCP is now banned in this country because it is believed to cause cancer and sterility, there are no restrictions on selling this pesticide to foreign countries.

Banana plantations in Costa Rica, Honduras and Ecuador buy DBCP from us. They use it to kill soil-dwelling worms that attack the bananas. Then they ship the sprayed bananas back to the United States where you eat them.

Foreign Killers

Imported produce is more likely to be highly poisoned than food grown in our country. The reason? "Americans eat with their eyes," a Mexican agribusinessman said. "They won't buy a fruit or vegetable with any insect marks or blemishes, so we spray them heavily. About four times as much spray as we use on our domestic crops. No insects ever touch that food."

And probably neither should you.

Strawberries from Mexico often have residues of *60 or more* pesticides. A single head of imported lettuce had 11 different poisons used on it.

Bananas from Central and South America had 45 "allowable" (by FDA standards) pesticides *plus* 25 prohibited pesticides *and* 37 additional poisons that are not normally detected by FDA tests. Mexican tomatoes had 53 "allowable" pesticides, another 21 banned pesticides, and an additional 28 unidentifiable sprays and poisons. The FDA frequently finds mysterious, unknown poisons in imported foods no doubt illegal pesticides that were manufactured and sold by the United States.

The FDA rarely, seizes these poisoned food shipments or refuses them entry. Instead, they remove a small sample of the food for testing and send the rest to the marketplace. By the time they run the test and discover the deadly pesticides, the food is already in your stomach.

During one recent 15-month period, half of the imported food identified as *heavily* pesticide-contaminated was sold without penalty or warning to the American public.

The government is not protecting you. The pesticide manufacturers certainly won't protect you. It's up to you.

What Can You Do?

You cannot avoid pesticide poisoning. By now, the waterways, the soil and the rain are so polluted by them that it will take at least 20 to 40 years to eliminate them from the environment even if we start today.

Is it hopeless? Do we have to sit back and allow ourselves to be poisoned for someone else's pocket-book? No. You can take actions today that may save the lives and health of all the people and wildlife on this planet. Here's how:

Economic Action

As much as possible, boycott the giants of agribusiness who are chiefly responsible for pesticide production and use. Buy local and organic produce as much as possible. Support the small, independent grower.

Tell your local grocery store that you want more homegrown and unsprayed produce. Spend your dollars wisely so as to give little support to the food industries that use poison for profits.

Political action

Let your congressmen at the state and federal levels know about your deep concern for the pesticide problem. Write letters, emphasizing that their actions in this one area will greatly determine how you will vote.

Protest the exportation of pesticides to other countries. These poisons find their way back to your dinner table. Insist that federal agencies be more responsive and stringent in monitoring pesticide levels. Tell your representatives that you want more funding for environmental protection agencies.

A list of consumer action groups that are lobbying for stricter pesticide control is included' with this

article. Contact them for additional information about how you can help.

Consumer Action

You can consume less pesticides by growing your own food. If you have extra room, grow additional poison-free food for friends and relatives. However, realize that pesticides are now throughout the environment. Rains carry deadly poisons from around the world and deposit them in your garden. Even homegrown and organically-grown food is now being pesticide contaminated due to our polluted waterways. You can't run away anymore from the problem—it's being brought home to you, like it or not.

If you can't garden or raise your own food, grow sprouts. These are virtually poison free food and may be had fresh all year round. Sprouting dried seeds and grains can help you consume less supermarket poisoned foods.

A Good Diet Can Help!

Yes, you can eat certain foods and avoid others to reduce your pesticide poisoning. By wisely choosing your foods, you can consume up to 100 times less poisons than the average person. Here's how:

1. *Avoid meat and dairy products.* Pesticide residues are 16 times to several hundred times higher in meat and milk products than in fresh fruits and vegetables

Animals must eat 16 pounds of plant material to produce one pound of flesh. The poisons in the feeds and plants are concentrated in the fat and vital organs of the animal. When you eat the meat, it's like getting a super-concentrated dose of pesticides. The pesticides that are bonded in the animal fat is even more difficult for the body to handle than the pesticides found in the fruits and vegetables. When pesticides are subject to heating as well (as in the cooking of the meat), additional dangerous chemical changes occur

The former secretary of Health, Education and Welfare, Robert Finch, said: "If strict enforcement of pesticide residues in meat, dairy products and eggs existed, I fear we would have to become a nation of vegetarians." Actually, the fear should be that we *won't* become a nation of non-meat eaters

Although DDT contamination of fruits and vegetables has now slightly decreased since the limited 1973 ban, pesticide poisons in livestock, poultry and fish have steadily increased. Animal fat is a storehouse of poisons. The more fat in your diet, the more poisons. It's that simple

Remember too that it is now impossible to consume any dairy food in any form and *not* receive dangerous levels of DDT. High-fat dairy products are, of course, the worst.

2. *Limit or reduce grain products.* Grain farming is most conducive to heavy spraying and monocrop farming. After a few years of continual spraying, the grain fields become saturated with high doses of pesticides

The safest grain to eat is wild rice. Corn and wheat are among the heaviest sprayed.

3. *Buy organic food or grow your own.* Obviously if you grow or buy unsprayed food, you'll get less pesticides. Remember, however, that as long as there are pesticides used anywhere in the world, your food will still be contaminated. The only sure way to prevent pesticide poisoning is to make certain that these chemicals are not released into the environment in the first place.

4. *Use careful food preparation.* You can remove some surface pesticides by washing them with a harmless soap to remove oil-based poisons, vinegar or lemon juice to remove alkali-based sprays, and soda for acid-based sprays. Make sure all such washed produce is then cleansed with water (preferably distilled to avoid other contaminants)

You can peel some fruits and vegetables (especially waxed produce). You should remove outer leaves of green vegetables

Once again, however, these are not sure protection measures. Most pesticides are not on the surface of the food, but are throughout the entire system of the plant. The poisons may be entirely *intercellular* and none may be on the surface at all.

5. *Avoid most imported produce.* Food that is imported has often been more heavily sprayed and with poisons banned in this country. This is not always true, however. For instance, many foreign countries will not let U.S. produce come into their country because of the poisons we use. Oftentimes, the food you get *inside* these countries is safer than what is grown inside the U.S. It's just that to produce high-cosmetic produce for Americans, the foreign countries heavily spray their export crops.
6. *Avoid produce that receive the highest amount of spraying.* This is often difficult to determine, as pesticide use is not consistent for any crop across the country. In general, "soft" fruits which are more prone to insect attack will usually be more heavily sprayed than those foods with a naturally protective layer or skin.
7. *Don't worry.* Strange advice after all these warnings, but you should realize that at this time, it is impossible to avoid all pesticides. Worrying does no good anyway; action is what is needed.

If you follow a good diet, you can be protected from most of the harmful effects of pesticides. For instance, uncooked foods present less of a problem to the body as it tries to separate the poisons from the food. If you cook your food, you're creating chemical bonds with the poisons that may present difficulty. A little poison on your fresh fruits and vegetables won't hurt you as much as the high amount of poisons most people get in the typical high-fat, high-meat American diet.

Fasting can help your body eliminate the pesticide poisons by burning up those fat deposits where the residues are stored. As these poisons are released during the fast, you may experience the usual symptoms of pesticide poisoning—nausea, headaches, irritability, etc. It's uncomfortable, but fasting and/or the eliminating of this body fat may be the only way of ridding yourself of the pesticide load.

Fight Back!

Remember, you don't have to sit back and be continually poisoned. You're not helpless. You have to take action. You're fighting for your life.

No one is immune from pesticide poisoning. We are killing the birds, the animals, the children and all life on our planet by the crazy, unjustifiable use of deadly pesticide poisons.

We have a chance. There are still people—people like you—who believe health, life and, well-being are more important than a few extra dollars for a poison manufacturer or for the chance to eat an "unblemished" apple.

But you can't wait any longer. You've got to fight back—now —because with the next bite you eat, you've just been poisoned